

What is claimed is:

- 1           1.     A sensor unit for sensing process parameters of a process to manufacture  
2     an integrated circuit using integrated circuit processing equipment, the sensor unit  
3     comprising:  
4                 a substrate having a wafer-shaped profile;  
5                 a first sensor, disposed on or in the substrate, to sample a first process  
6     parameter; and  
7                 a second sensor, disposed on or in the substrate, to sample a second  
8     process parameter wherein the second process parameter is different from the  
9     first process parameter.
- 1           2.     The sensor unit of claim 1 further including at least one battery, disposed  
2     in the wafer-shaped substrate, to provide electrical power to the first sensor.
- 1           3.     The sensor unit of claim 1 further including communications circuitry  
2     disposed on the substrate, wherein the communications circuitry is coupled to the first  
3     and second sensors to provide data to an external device wherein the data is  
4     representative of the first and second process parameters.
- 1           4.     The sensor unit of claim 1 further including a first source, disposed on or  
2     in the substrate, wherein first source generates an interrogation signal and wherein the  
3     first sensor uses the interrogation signal from the first source to sample the first process  
4     parameter.

1           5.     The sensor unit of claim 4 further including a second source, disposed on  
2 or in the substrate, wherein second source generates an interrogation signal and  
3 wherein the second sensor uses the interrogation signal from the second source to  
4 sample the second process parameter.

1           6.     The sensor unit of claim 4 wherein the first sensor and first source operate  
2 in an end-point mode.

1           7.     The sensor unit of claim 6 wherein the second sensor operates in a real-  
2 time mode.

1           8.     The sensor unit of claim 7 further including data storage to store data  
2 which is representative of the second parameter.

1           9.     The sensor unit of claim 7 wherein the sensor unit further includes:  
2                 data compression circuitry to compress the data which is representative of  
3 the second parameter;  
4                 communication circuitry, coupled to the data compression circuitry, to  
5 provide the data which is representative of the second parameter to external  
6 circuitry; and  
7                 at least one rechargeable battery, to provide electrical power to the data  
8 compression circuitry and the communication circuitry.

1           10.    The sensor unit of claim 1 wherein the first sensor operates in a real-time  
2   mode.

1           11.    The sensor unit of claim 10 further including:  
2                   data storage to store data which is representative of the first parameter;  
3                   data compression circuitry to compress the data which is representative of  
4   the first parameter;  
5                   communication circuitry, coupled to the data compression circuitry, to  
6   provide the data which is representative of the first parameter to external  
7   circuitry; and  
8                   at least one rechargeable battery, to provide electrical power to the data  
9   compression circuitry and the communication circuitry.

1           12.    The sensor unit of claim 10 wherein the first sensor samples the first  
2   parameter periodically or continuously while the sensor unit is disposed in the integrated  
3   circuit processing equipment and undergoing processing.

1           13.    The sensor unit of claim 1 wherein the first sensor is a temperature sensor  
2   and the second sensor is a pressure sensor.

1           14.    The sensor unit of claim 1 wherein the first sensor is a temperature sensor  
2   and the second sensor is a chemical sensor.

1           15.    The sensor unit of claim 1 wherein the first sensor is a temperature sensor  
2   and the second sensor is a surface tension sensor.

1           16.    The sensor unit of claim 1 wherein the first sensor is a temperature sensor  
2   and the second sensor is a surface stress sensor.

1           17.    A sensor unit for sensing a first process parameter of a process to  
2   manufacture an integrated circuit using integrated circuit processing equipment, the  
3   sensor unit comprising:

4                a substrate having a wafer-shaped profile;

5                a source, disposed on or in the substrate, to generate an interrogation  
6   signal; and

7                a first sensor, disposed on or in the substrate, to sample a first process  
8   parameter using the interrogation signal from the source.

1           18.    The sensor unit of claim 17 wherein the source and the first sensor  
2   operate in an end-point mode.

1           19.    The sensor unit of claim 17 wherein the source and the first sensor  
2   operate in a real-time mode.

1           20.    The sensor unit of claim 19 further including data storage to store data  
2   which is representative of the first parameter.

1        21.    The sensor unit of claim 19 wherein the sensor unit further includes:  
2                data compression circuitry to compress the data which is representative of  
3        the first parameter;  
4                communication circuitry, coupled to the data compression circuitry, to  
5        provide the data which is representative of the first parameter to external  
6        circuitry; and  
7                at least one rechargeable battery, to provide electrical power to the data  
8        compression circuitry and the communication circuitry.

1        22.    The sensor unit of claim 17 wherein the source is a VCSEL or LED.

1        23.    The sensor unit of claim 22 wherein the first sensor is a CMOS devices,  
2        charge coupled devices, or photodiode.

1        24.    The sensor unit of claim 23 wherein the first parameter is the surface  
2        profile.

1        25.    The sensor unit of claim 23 wherein the sensor unit further includes a  
2        predetermined surface layer which is disposed above the source and the first sensor.

1        26.    The sensor unit of claim 25 wherein the predetermined surface layer is  
2        comprised of a material that facilitates light propagation or scattering.

1           27.    The sensor unit of claim 17 wherein the first sensor periodically or  
2 continuously samples the first parameter while the sensor unit is disposed in the  
3 integrated circuit processing equipment and undergoing processing.

1           28.    The sensor unit of claim 27 further including data storage, coupled to the  
2 first sensor, to store data which is representative of the first parameter.

1           29.    The sensor unit of claim 27 wherein the sensor unit further includes:  
2                   communication circuitry, coupled to the data compression circuitry, to  
3 provide the data which is representative of the first parameter to external  
4 circuitry; and  
5                   at least one rechargeable battery, to provide electrical power to the data  
6 compression circuitry and the communication circuitry.

1           30.    The sensor unit of claim 29 wherein:  
2                   the source is a VCSEL or LED;  
3                   the first sensor is a CMOS devices, charge coupled devices, or  
4 photodiode; and  
5                   wherein the sensor unit further includes a predetermined surface layer  
6 which is disposed above the source and the first sensor.

1           31.    The sensor unit of claim 30 wherein the first sensor samples the intensity  
2 of reflected or scattered light.

1           32.    The sensor unit of claim 31 further including a temperature sensor to  
2   sample temperature, in a real-time mode, while the sensor unit is disposed in the  
3   integrated circuit processing equipment and undergoing processing.

1           33.    The sensor unit of claim 32 wherein the temperature sensor periodically or  
2   continuously samples the temperature.

1           34.    A sensor unit for sensing a first process parameter of a process to  
2   manufacture an integrated circuit using integrated circuit processing equipment, the  
3   sensor unit comprising:

4                   a substrate having a wafer-shaped profile;

5                   a first source, disposed on or in the substrate, to generate an interrogation  
6   signal; and

7                   a first sensor array including a plurality of first sensors disposed on or in  
8   the substrate, wherein the first sensors sample a first process parameter using  
9   the interrogation signal;

10                  a second sensor array including a plurality of second sensors disposed on  
11   or in the substrate, wherein the second sensors sample a second process  
12   parameter wherein the second process parameter is different from the first  
13   process parameter.

1           35.    The sensor unit of claim 34 wherein the second sensors operate in a end-  
2   point mode.

1           36.    The sensor unit of claim 34 wherein the second sensors operate in a real-  
2 time mode and sample the second process parameter continuously or periodically while  
3 the sensor unit is disposed in the integrated circuit processing equipment and  
4 undergoing processing.

1           37.    The sensor unit of claim 34 wherein the first source and the first sensors  
2 operate in an end-point mode.

1           38.    The sensor unit of claim 34 wherein the first source and the first sensors  
2 operate in a real-time mode.

1           39.    The sensor unit of claim 38 further including:  
2                   data storage to store data sampled by the first sensors;  
3                   communication circuitry, coupled to the data storage, to provide the data  
4 which is representative of the first parameter to external circuitry; and  
5                   at least one rechargeable battery, to provide electrical power to the first  
6 source, the first sensors, the data storage and the communication circuitry.

1           40.    The sensor unit of claim 38 wherein:  
2                   the first source is a VCSEL or LED;  
3                   the first sensor is a CMOS devices, charge coupled devices, or  
4 photodiode; and



5                    wherein the sensor unit further includes a predetermined surface layer  
6                    which is disposed above the first source and the first sensor.

1            41.    The sensor unit of claim 40 wherein the first sensor samples the intensity  
2 of reflected or scattered light.

1            42.    The sensor unit of claim 41 wherein the second sensors are temperature  
2 sensors.

1            43.    The sensor unit of claim 42 wherein the temperature sensors sample  
2 temperature, in a real-time mode, while the sensor unit is disposed in the integrated  
3 circuit processing equipment and undergoing processing.

1            44.    The sensor unit of claim 43 wherein the temperature sensors periodically  
2 or continuously sample the temperature.

1            45.    The sensor unit of claim 34 wherein the second sensors are pressure  
2 sensors.

1            46.    The sensor unit of claim 34 wherein the second sensors are light intensity  
2 sensors.

1            47.    The sensor unit of claim 34 wherein the second sensors are chemical  
2 sensors.

1            48.    The sensor unit of claim 34 wherein the second sensors are surface  
2 tension sensors.

1            49.    The sensor unit of claim 34 wherein the second sensors are surface stress  
2 sensors.

1            50.    The sensor unit of claim 34 wherein the second sensors are surface  
2 profile sensors.